Florida Springs Restoration and Preservation Efforts:

Coordinating a Collaborative Adaptive Approach

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# ABSTRACT

The Florida Springs Region in the north and central portions of the state boasts over 1,000 artesian springs that discharge from the Floridan Aquifer System. However, social and economic development in the state has negatively impacted spring flows, reducing spring health and indicating the state’s water supply is imperiled. Adopted legislation and efforts to restore and protect spring flows have failed to reverse the decline. Adaptive governance has been successful in addressing social-ecological problems in many water resource issues. In this study, a gap analysis is used to identify where elements of adaptive governance may need strengthening in the efforts to restore and preserve spring flows in the Florida Springs Region. Recommendations to achieve a more robust and interactive adaptive governance model are provided.

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# INTRODUCTION

North Florida is home to over 1,000 artesian springs. With the largest concentration of first magnitude springs –springs with flow rates exceeding 100 cubic feet per second- in the world, the Florida Springs Region is a treasure to the natural world and to the state’s inhabitants. Despite their significant, the Howard T. Odum Florida Springs Institute (FSI) (2018, p.3) reports that “nearly all” of the state’s springs suffer from reduced flows and water pollution as a result of increased urban, commercial, and intensive agricultural development. Ironically, one of the natural resources that entices residents, tourists, and agriculture to the state is degraded by that attraction. Through 2015, half of the region’s 32 sentinel springs were rated D+ or lower, and 75% were below a B- (FSI, 2018, p. 21). Some springs have stopped flowing and additional springs are predicted to cease flow without corrective intervention. State regulations codified to preserve the springs are not adequate and efforts by agencies given protective authority by the state conflict with local efforts to restore those same springs.

FSI lists five historical and current impacts that effect spring health: excessive groundwater extraction, nitrate pollution, physical modifications, invasive species control, and excessive recreation. Each of the five impacts pose hazards to the health of Florida springs; this case study will concentrate on one of the most urgent of those problems. The narrative in this case study will describe how reduced spring flows indicate declining water levels in the Floridan Aquifer, implications of the decline, the history of springs protection legislation, and efforts that are underway or proposed in recovery plans to restore the springs to their historic flows and/or to preserve adequate flow. The limitation on the scope of this case study recognizes the complexity of the issues facing springs restoration and preservation and the diversity of stakeholders involved in those efforts. The limited scope is undertaken with the understanding that separating the water quantity and water quality issues is not a practical recommendation but is a means to exploring solutions to conflict in water issues.

# CASE STUDY NARRATIVE

## Background

A brief overview of spring hydrogeology is necessary to understand the impact of spring flow decline in the Florida Springs Region on the citizens of Florida. What is a spring? A spring is where groundwater discharges to the land surface in response to gravity and pressure (Knight, 2015, p. 15). Groundwater is any water that is stored underground. The artesian springs in the Florida Springs Region discharge from the Floridan Aquifer System (FAS). The FAS is an underground reservoir composed mainly of limestone and dolostone that contains trillions of gallons of freshwater. It is one of the largest aquifers in the United States and lies beneath the entire state of Florida, the coastal plains of much of Georgia, and portions of South Carolina, Alabama, and Mississippi. The FAS is recharged by rainfall and surface water. Areas of high recharge are those with the most permeable land surfaces, which is primarily north and central Florida. As recharge places pressure on the water in the aquifer, springs occur where cracks and tunnels exist in the confining walls of the aquifer. Recharge flows downhill to the aquifer so that the springs at higher elevations will have the least pressure and be the first to stop flowing.

Why is the decline in spring flow important to Floridians? Dr. Robert Knight of the Florida Springs Institute (FSI) included a statement in his lecture in the *Springs Academy* (2016) that the study of the springs is a good “case history” to gain an overall understanding of Florida’s water resource issues. The Florida Springs Region encompasses at least a portion of 53 of Florida’s 67 counties, or 65 percent of the state’s land and water area, and covers the north and central parts of the state extends south to Sarasota and Okeechobee counties (FSI, 2018). The same aquifer that discharges as springs is used by more than 90 percent of the people in northeast and east-central Florida for their water consumption needs. With a projected state population increase of 33% by 2040 (Asci, Borisova, Dukes, 2017, p. 66), meeting the demand for water for public supply presents a significant risk. Declining spring flows are a signal that the state’s drinking water supply may be imperiled.

Additional reasons for concern for the declining spring flows include the following:

* Decline in pressure from freshwater layer may lead to saltwater intrusion and processes for water desalination are costly
* Healthy springs provide economic value with recreation and tourism opportunities
* Water quality is compromised by declining flow
* Sinkholes may develop
* Healthy springs ecological systems are critical habitat for plants and animals
* Non-flowing springs become yellow or green (unattractive)
* Flowing springs are essential to the continued flow of Florida’s freshwater surface system
* Increased cost of extraction at lower aquifer levels

## History of Florida Springs Protection

### Florida Springs Regulation

The 1972 Florida Water Resources Act established that Florida’s surface and groundwater are a public resource. Management oversight was placed with the Florida Department of Environmental Protection (FDEP) for statewide jurisdiction and the five regional water management districts (WMDs) were provided oversight of areas based on hydrologic boundaries. The WMDs are funded by local taxing authorities. Florida waters includes rivers, streams, wetlands, lakes, springs, aquifers, and estuaries.

Section 373.246, Florida Statutes (1972), grants WMD governing boards the power to issue and enforce water shortage orders. WMD water supply programs include compliance and enforcement of the permitting of consumptive water use (Fla. Stat. §373(2) (1972)). Each WMD sets its own rules that govern its issuance of consumptive water use permits (CUPs) for withdrawals of water from the aquifer at a rate greater than 100,000 gallons per day. Section 373.042 requires that the WMDs set minimum flows and minimum water levels (MFLs) of groundwater in an aquifer. Those levels are to be set to limit further extraction that would be “significantly harmful to the water resources or ecology of the area.” Under this regulation, any spring that currently or is expected to fall below the MFL in the next 20 years must have a recovery plan drafted. Section 373.709(6) requires that each WMD conduct water supply planning based on a 20-year planning period using projected water demand over that period.

The Florida Springs and Aquifer Protection Act (“Springs Protection Act”) was adopted by the Florida Legislature in 2016 (FLA. STAT. §373(8). The Springs Protection Act proclaimed as “Outstanding Florida Springs” (OFS) 24 first magnitude springs and six second magnitude springs. Annually, the WMDs are required to submit a priority list of water bodies for which they will establish MFLs to the FDEP for review and approval (Borisova, Olexa & Davis, 2017, p. 2). If a WMD failed to adopt MFLs for an Outstanding Florida Spring by July 2017, the FDEP was authorized to make an emergency ruling. At the same time an MFL is established, any OFS that fails to meet the MFL requires a recovery plan be submitted simultaneously.

Local governments also play a role in protecting the springs through plans and legislation in the Natural Resources or Conservation Element of their comprehensive plans, zoning laws, land development regulations, tiered water billing rates, and irrigation ordinances.

### Florida Springs Initiative

As a result of a report published in November 2000 by the Springs Task Force - a group of scientists, planners, and private citizens, the Florida legislature established Governor Jeb Bush’s Florida Springs Initiative in 2001. The programs undertaken by the Florida Springs Task Force and Springs Initiative were opposed by private and public big money interests. Knight (2015, p. 141) attributes the pushback to the fact that Florida’s cheap groundwater was the basis of the expansion of agriculture, urbanization, tourism, and housing markets in the state. On June 1, 2011, the FDEP announced the end of state funding for springs science and protection. In its ten-year life span, approximately $25 million was appropriated by the Florida legislature for springs protection. Since that time, there has been no substantial legislation to fund springs protection to pass into law (Knight, 2015, p. 126).

## Springs Recovery Efforts – In Place and Planned

This case study reviews the efforts that are in place and those that are recommended in the plans and strategies of four diverse stakeholders in spring recovery efforts. The selected four stakeholders reflect differing priorities and objectives, but also share some goals. The necessary actions suggested by these organizations span a wide range that includes new regulations and restrictions on water use, monitoring existing regulations using adaptive management, providing financial incentives and charging fees, instilling a water ethic, technological innovation, public outreach and education on conservation, and a rebalance of political power to mobilize and activate citizen resolve. Specific recommendations are presented in Tables 1-4, and are color-coded according the parties’ self-categorization (Figure 1). The categorization reflects the perspective from which the party views the goals of spring recovery, as described below.

Figure 1. Stakeholder self-categorization.



### Suwanee River WMD (SRWMD) Lower Santa Fe River Basin Recovery Strategy

The Lower Santa Fe River Basin is in recovery due to failure to meet targeted MFLs in a study dated November 2013. The SRWMD’s *Recovery Strategy: Lower Santa Fe River Basin* is an example of a recovery plan developed by a WMD that is required by section 373.0421(2), Florida Statutes. Components of the strategy to restore the spring flows to the MFLs are presented in Tables 1-4.

### North Florida Regional Water Supply Partnership (NFRWSP)

Two of the WMDs – SRWMD and St. Johns River WMD (SJRWMD) - and the FDEP entered into an Interagency Agreement in September 2011 to formalize coordinated efforts to protect the water resources and to provide for equitable treatment of water users in north Florida (SWRMD Contract, 2015). The North Florida Planning Region is comprised of 14 counties in the two WMDs. The parties agreed to develop a consistent process for developing MFLs, and to prepare a joint 20-year regional water supply plan as required by Florida Statutes (§ 373.709(2)). The NFRWSP was formed to implement the North Florida Regional Water Supply Plan for 2015-2035 (SJRWMD & SRWMD) and was approved by the governing boards of the two WMDs in January 2017. The Executive Summary to the NFRWSP Plan states that the projected increase in water demand over the 20-year period cannot be supplied by groundwater alone without causing unacceptable harm to the area’s water resources. The Plan estimates that conservation efforts proposed could decrease the projected water demand by 46% and acknowledges that an important part of the organization’s process is to identify water supply development project options (p. 53). Those projects that will be the responsibility of local governments include public or private facilities for water collection, production, treatment, transmission, or distribution. Recommended conservation efforts and water supply projects are presented in Tables 1-4.

### Howard T. Odum Florida Springs Institute (FSI)

The Howard T. Odum Florida Springs Institute (FSI) is a science-based educational nonprofit organization (FSI, Story Map) located in High Springs, Florida. In the absence of complete implementation and enforcement of regulatory programs, FSI was formed by local springs stakeholders in 2010 to provide the comprehensive management needed to restore and preserve the springs. FSI performs monitoring of the springs by collecting water samples for testing and documenting water quality data. The information gathered is used to develop recommendations for necessary actions to restore and maintain spring health, and to educate individuals, businesses, and state government of those recommendations.

FSI has continued the development of springs restoration plans initiated by individual working group efforts that were previously funded by the Florida Springs Initiative. Several of those plans have been completed and are located on the organization’s web site (FSI, Plans & Reports). Each plan includes a description of the physical springs system, a record of the changes in springs flow, a review of existing regulations and protections, a summary of the actions needed to achieve spring recovery, and the local and state and public interest groups who can best implement those strategies.

In addition to restoration plans for individual springs focus groups, FSI drafted the Florida Springs Conservation Plan (2018), which provides goals to achieve for each of the five identified threats to Florida springs (p. 5). Actions recommended to attain spring flow recovery are included in Tables 1-4.

### Robert Knight, Ph.D., Executive Director and Founder of FSI

In his “Recovery Recipe,” Knight (2015, Chapter 9) lists several actions that need to be taken and goals that must be met to recover the Florida Springs System. He also notes that implementation of the recovery plan will require public education and motivation, political will, and funding that is currently lacking. Action items related to recovering spring flows that are included in Knight’s Recovery Recipe are presented in Tables 1-4.

Table 1. Command and Control Policies



Table 2. Market-Based Approach



Table 3. Public Advocacy Approach



Table 4. Water Supply Projects



### Adaptive Management

One obstacle to implementing effective policy for springs restoration and preservation is the perception of the lack of conclusive science. Environmental policy decision makers must confront tradeoffs and they are at the same time faced with uncertain and changing science in their consideration of choices. Pros and cons to every potential tactic can lead to paralysis while the opportunity to make impactful positive changes is missed. To encourage decision making rather than delaying action or accepting the status quo despite worsening conditions, following adaptive management techniques can remove some uncertainty. With adaptive management, actions implemented to increase or preserve spring flow are monitored and feedback is used to strategically change methodology.

Table 5 illustrates that each of the four stakeholders identified above has adopted or advocated for principles of adaptive management. FSI specifically recommends using adaptive management (FSI, 2018, p. 29) because of the need for urgent action. Monitoring is essential to the adaptive management practices endorsed by FSI.

Table 5. Adaptive Management Techniques



## Current Status of Florida Springs Restoration

Despite the legislation requiring the WMDs to establish MFLs, Knight (2015, p. 130) states that as of 2014 (which is 42 years after the passage of the Florida Water Resources Act), the Northwest Florida WMD had failed to set any MFLs; the SRWMD had developed final MFLs for only 4 springs, and the SJRWMD had not adopted draft MFLs for over 25 springs that feed the Silver River. Studies conducted by the WMDs indicate that spring flows should not be reduced by more than an average 5 to 10% to prevent “significant harm.” Studies indicate that the overall average flow decline since the 1930’s is 32%, ranging from 16 to 46% (Knight, p. 55).

The Florida Springs Council (FSC), a non-profit coalition of organizations active in springs restoration efforts, contends that Florida’s water permitting system as it is overseen by the WMDs is broken, and that Florida must stop giving away its water for free. FSC (2019) contends that the WMDs fail to issue CUPs consistent with the public interest and natural resource protection, thereby leaving Floridians vulnerable to the impacts of over-extraction of groundwater.

## Flowing Forward

Achieving springs restoration and sustainable preservation is an especially complex social-ecological problem for many reasons. A balance must be struck between the needs of the human population and natural systems. The geographic boundaries of a spring system do not coincide with those of governmental and other regulatory bodies. Obstacles to sustainability are inherent in regulatory agencies where management is appointed by elected leaders with term limits in a changing political environment. The best available science upon which regulation is based is constantly evolving, and the health of a natural system such as a spring is dependent on unpredictable and changing climate and weather-related patterns. Added to all of this are the usual challenges to implementation of public policy and the regulation of a public good.

Considering Knight’s (2015, Chapter 9) recovery recipe ingredients, this case study embarked on a review of similar case studies on water resource issues to answer the following question: Is there a governance structure that can deliver the public motivation, political will, and funding needed to overcome the obstacles to implementation of policy and the embracing of a water ethic that FSI cites as necessary for springs restoration and preservation?

Case studies indicated that an adaptive governance structure is most equipped to govern social-ecological problems such as water resource conflicts. Adaptive governance extends the techniques of adaptive management in dealing with scientific uncertainty to include social and economic uncertainties. Scholz and Stiftel (2005, p. 1) note that current governance structures were often set in place in an earlier generation in response to a single type of collective problem, such as an urban, industrial, or agricultural issue. The WMDs represent the specialized agencies created to deal with Florida’s water supply issue. Ruhl (2005, p. 130) refers to the entities of those governance structures as “first-order institutions.” Accelerated growth and development have spawned more complex collective problems from resource overuse and the conflict between first order agency objectives. “Second-order collective action conflicts” are those where separate agency goals cannot all be attained. Scholz and Stiftel (2005, p. 5) call these “wicked problems” that will require evolved governance institutions that use adaptive governance principles to reach mutual, sustainable, long-term solutions through coordinated efforts.

Thus the question to be addressed in the analysis was refined to ask:

Are principles of adaptive governance sufficiently present in the efforts to restore and preserve Florida’s springs to lead to an evolved response?

# CASE STUDY ANALYSIS

## Gap Analysis Methodology

An answer to the question of whether the principles of adaptive governance are sufficiently present in the efforts to restore and preserve Florida’s springs required that a gap analysis be performed. The following framework was used for the analysis in this case study: 1

1. “Determinants” of adaptive governance consistently identified in a literature review of research on adaptive governance were compiled (Table 6);
2. The determinants were operationalized as “indicators” that adaptive governance is manifested through a review of case studies of water governance problems (Table 7);
3. For each indicator, current efforts and those recommended or planned in springs restoration and preservation efforts were identified from Tables 1-5 (Table 8);
4. Further analysis was performed on significant gaps.

1Steps 1 and 2 are based on the methodology used by Hill (2013) in studying the adaptive capacity of water governance regimes in the Alps and the Andes to mitigate impacts of climate change.

## Determinants of Adaptive Governance

A literature review of adaptive governance frameworks reveals a wide range of governance principles to consider in implementing adaptive governance. Recurring concepts in the literature on adaptive governance include but are not limited to those included in Table 6.

Table 6. Determinants of Adaptive Governance



## Indicators of Adaptive Governance

Indicators of adaptive governance were compiled through a review of case studies on water governance issues. The indicators were considered to be significant factors for adaptive governance to have achieved a positive impact. Following the categorization used by Hill (2013), the indicators are grouped in Table 7 as related to regime, knowledge, or network.

Table 7. Indicators of Adaptive Governance



## Gap Identification

The gap analysis results displayed in Tables 8-10 include details of where the indicator of adaptive governance was noted to be present and where an indicator was considered to be missing or not fully implemented. The analysis considered both current efforts to restore the springs and proposed actions included in the SWWMD and NFRWSP plans and in the recommendations in the FSI Springs Conservation Plan and Knight’s Recovery Recipe. The gap analysis uses Hill’s (2013) categorization of regime, knowledge, and networks to organize the discussion of the results.

### Gaps in Regime

Table 8. Gap Analysis: Regime



Stakeholders find a gap exists in accountability. There is a need for greater enforcement to hold the WMDs accountable for monitoring and enforcing the MFLs in issuing CUPs, as well as enforcement by the FDEP of the timely setting of the MFLs. Hicks and Leeper (2016, p. 296) note that many of the established MFLs are not currently being met or are projected to not be met in the next 20 years, which requires a recovery plan, which is not available for some springs that fall below the established MFL. Suggestions for stronger regulation include additional criteria for CUPs, caps and prohibitions on groundwater use, and mandatory conservation measures.

FSI has identified the role of uncertain science in the management of water resources. For example, baseline MFLs are a point of disagreement between agency and environmental hydrogeologists. Knight (2015, p. 142) advocates for being guided by the “precautionary principle.” The precautionary principle holds that in the protection of a natural resource from grave harm, action is justified even when the underlying science is conflicting or imperfect.

Adaptive governance extends the management of uncertainty in the ecological system to uncertainty in social and economic systems. A gap in managing for uncertainty exists in the NFRWSP Plan. NFRWSP (2015) forecasts water demand and supply deficit through 2035. However, according to the Plan (p. 11), the WMDs assume water supply based on existing sources and current commitments for alternative sources, which fails to fully consider uncertainties.

A gap in representation – or lack of diversity - in the appointees to the WMD governing boards was noted by FSC’s President, Dan Hilliard (2019), in a letter to Florida Governor Ron DeSantis. Hilliard alleges that those governing boards are no longer selected from a variety of fields and expertise, and that there is no representation from the environmental or scientific communities. In many cases, there are vacancies that result in decisions made by a slim quorum (FSC, 2019). The advisory committee for the NFRWSP included a diverse group of representatives (regime indicator) from several stakeholder groups; however, comments submitted by local springs advocates claimed not all interests were represented.

Additional gaps identified in regime indicators include the need for greater public awareness of the factors impacting springs health and the potential impacts to natural resources and the water supply. Bioregional scales used may be inaccurate because the WMD boundaries are based on regional surface water systems and springsheds have different and changing boundaries. Resources are insufficient to fund the educational, scientific, and physical needs to restore the springs. The state and regional agencies do not maneuver at a speed to permit successful adaptation, and in fact continue to permit wells when MFLs are not met.

### Gaps in Knowledge

Table 9. Gap Analysis: Knowledge



The use of adaptive management techniques was detailed in the narrative section of this study. Adaptive management encompasses most of the knowledge indicators: it is science-based; relies on experimentation; and requires monitoring and feedback to inform the basis of the science used for future actions. A gap may exist, however, in the feedback to awareness loop.

Researchers from the University of Florida, Gainesville and Universidad del Rosario, Bogotā D.C., Columbia (Kreye, Adams, Escobedo, & Soto, 2016) used a web-based choice survey method to elicit public opinion on forest-water resource protection in Florida. The study asked respondents to assess the program benefit of aquifer recharge to protect drinking water supply. The value for the variable was extremely low and was attributed by the authors to a history of water policies and regulations in Florida that fail to adequately protect the aquifers. Adequate feedback on the results of experimentation and pilot studies may be necessary to change the perception. Feedback not only informs science; positive feedback can strengthen community engagement (a “regime” indicator) or build social capital (a “network” indicator).

### Gaps in Networks

Table 10. Gap Analysis: Networks



Adaptive governance frameworks recommend a multi-level, nested form of governance. Such a structure permits quick action on the level that is demanded by an emergent issue. A polycentric structure was noted in the Florida Springs Region. The FDEP is a state agency with delegated authority to regional entities (WMDs). Redundancy is evident in the NFRWSP, which is an agreement between the SRWMD and SJRWMD, and the FDEP. The nongovernmental organizations are organized at the individual spring level and at the focus group level.

Collaboration is evident among some groups working on behalf of the springs. FSC is a coalition; FSI works with the University of Florida’s law students and water institute. However, collaboration between levels of government and the nongovernmental organizations is lacking, as well as collaboration with agriculture, mining, and public water suppliers. Wondolleck and Yaffee (2000, p. xvi) stress that collaboration is not itself a panacea. Collaboration is the means by which a bridge is put in place to span the divide between competing interests that share a common goal. Mollinga, Meinzen-Dick, and Merrey (2007, p. 705) point out that changes in water management are inherently political. There will be winners and losers and some of those seated at the collaborative decision table will have greater power. The authors note that the discussion must be strategically guided to identify the shared objectives and the issues on which coalitions can be created to organize around specific efforts. In other words, the collaboration must be coordinated, and a gap may exist in this element of adaptive governance in the Florida Springs Region. Cooperation to gain buy-in from potential losers is required to create a governance structure where each institution can play an effective role (Mollinga, Meinzen-Dick, & Merrey, p. 709).

Fennell and Plummer (2010, p. 255) note that “social memory” is a factor in developing a robust adaptive capacity in a community. Social learning through a community’s experience with the success of a collaborative effort will enforce further adaptive governance strategies. Successes in experimental efforts should be publicized. Innovation should be rewarded.

### Windows of Opportunity

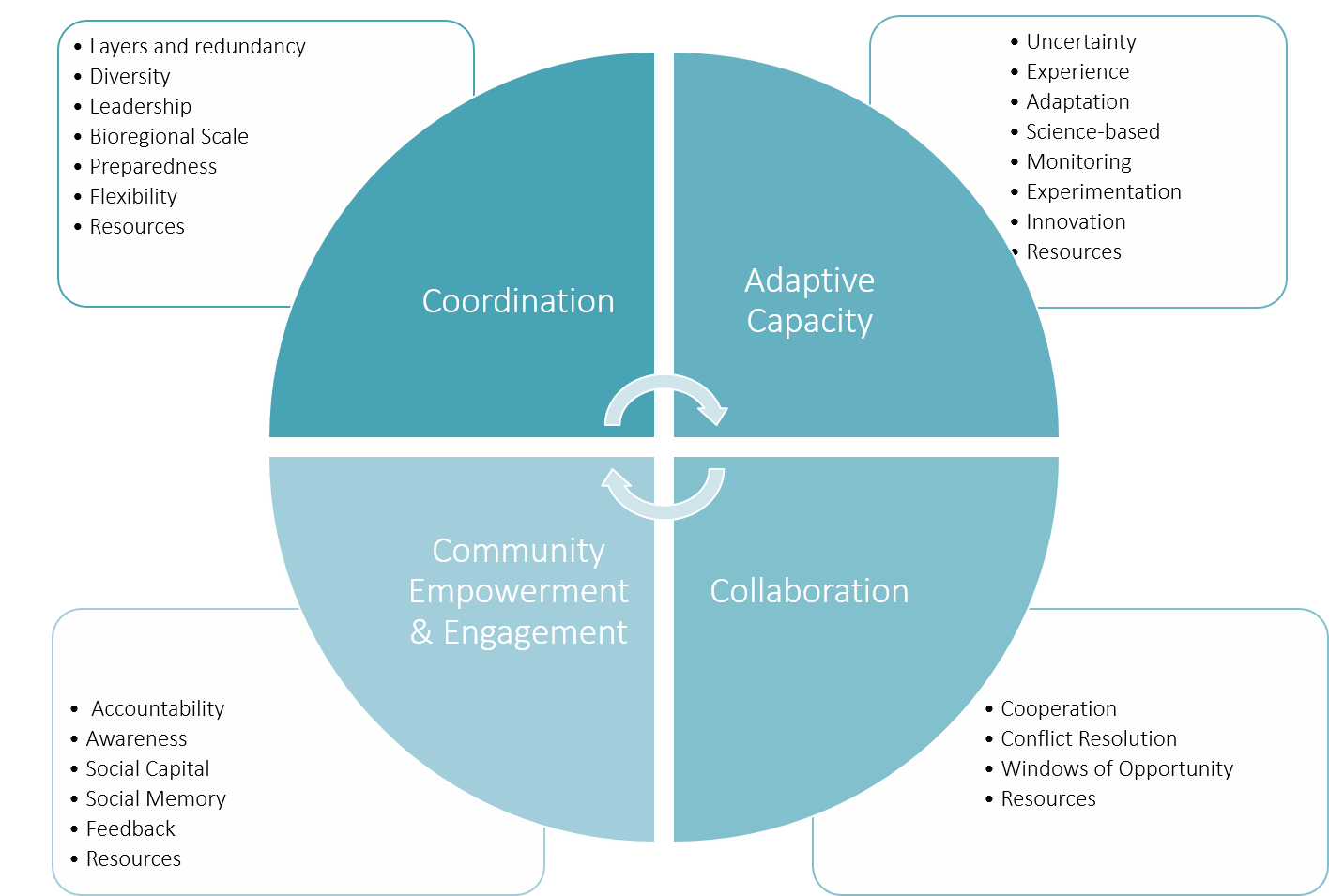
Another recurring element in the literature on adaptive governance is the exploitation of a window of opportunity. Sharma-Wallace, Velarde, and Wreford (2018, p. 181) note that scholars of adaptive governance cite the importance of seizing such a window of opportunity to effect governance transition. However, in half of the cases included their study where a window of opportunity opened, the governance structure failed. The researchers found that in these cases the stakeholders were not flexible and adaptive due to inadequate planning and preparation. A window of opportunity is not by itself sufficient to cause change.

A potential window of opportunity has recently presented itself in the SRWMD. Seven Springs Water asked the SRWMD to renew a CUP to withdraw up to 1.152 MGD near the Santa Fe River for the new owner’s Nestle water bottling operation (FSC, October 5, 2019, Nestle CUP). The original CUP was issued twenty years ago, prior to the river’s being placed under an MFL recovery strategy and the prior permit holder bottled only 300,000 gallons per day. A board member with Our Santa Fe River, Inc. points out that taxpayers are currently funding springs restoration and the Nestle bottling operation will further exacerbate the problem. Furthermore, the extraction is not in the public interest as the bottled water will be sold for private profit. The issue has generated worldwide media coverage and garnered local support, increasing public awareness of the impact that water extraction permits have on the health of local springs. Collaboration can also be increased in situations where there is a shared problem or fear, or a sense of crisis (Wondolleck & Yaffee, 2000, pp. 76-77).

## Governance Recommendations

The analysis of adaptive governance principles in this case study revealed that the numerous principles are interrelated. For example, feedback and experimentation beget social memory; being prepared for windows of opportunity (being flexible and adaptive) can lead to collaboration; coordination requires leadership; and so on. Figure 2 is a suggested model of the interdependent variables. The analysis suggests that a full complement of adaptive governance principles needs to be present to provide for a successful implementation.

Figure 2. Adaptive Governance Model



Gaps identified in the case study of governance in the Florida Springs Region spanned the range of the indicators of adaptive governance. However, examples of current and/or proposed or recommendations actions are present for most of the indicators. Three recommendations to close the gaps efforts are offered.

### Respond to Uncertainty with a Risk-Based Approach

Perform a risk assessment to identify all ecological, social, and economic uncertainties to mold a flexible and prepared governance structure able to overcome obstacles and take advantage of opportunities that emerge. Adaptive governance theory is reflective of an evolution away from seeking one optimal response in making policy decisions. Ostrom, Janssen, and Anderies (2007, p. 15176) state that there is usually no panacea for solving environmental problems. Environmental issues are by nature local or regional issues and the solutions will vary depending on many factors. They further state that to “go beyond panaceas” requires diagnosis of the multiple processes that occur in complex, nested social-ecological systems, monitoring the initial solutions, and using learning from applied science such as that used in other scientific disciplines. Modeling alternative outcomes based on extensive use of data from a variety of sources should be considered.

Hassanzadeh, Elshorbagy, Wheater, and Gober (2016, p. 291) used a water resource model to project water availability by simulating changing conditions under five different policy options. Results of their study of the water resource system in the Saskatchewan River Basin in western Canada revealed that no single policy provided the optimal option for water resource management for all stakeholders under every condition tested. The study suggests that using a risk-based framework and a model that incorporates the probability of outcomes under various policy options can provide valuable insight to prepare a governance structure able to respond most effectively to uncertain and changing conditions. Using such a model would allow for better computation of tradeoffs based on empirical data.

### Engage Conveners to Facilitate Consensus-Building

Scholz and Stiftel (2005, pp. 5-6) list as one of five challenges to adaptive governance the “challenge of deliberative process design,” which is the challenge in seeking and including a large number of participants and incorporating their input into the strategy. In social-ecological “wicked problems” where each party’s ideal solution cannot be achieved, cooperation by those with competing interests must be achieved. Trade-offs will be required to gain buy-in from the diverse stakeholders. Coordination and leadership is mandatory to develop and present options and to bring diverse entities to agreement to evolve from the current remedy for dispute resolution, which is through legal challenge.

Fuller (2009) compared two collaborative processes that attempted to build consensus between agriculture and environmentalists on issues of agricultural water use. One effort succeeded and the other failed. Fuller (p. 663) notes that the successful process led to “significant innovation and surprising risk taking by all sides.” Fuller attributes the success of that process to several factors beyond the scope of this analysis. However, the study highlights the level of skill and strategy needed to gain consensus where there are seemingly irreconcilable differences.

Oregon Solutions (About Oregon Solutions), associated with the National Policy Consensus Center in the College of Urban and Public Affairs’ Hatfield School of Government at Portland State University, refers to such a system and process of consensus-building as “collaborative governance.” Oregon Solutions provides a neutral forum, a “convener,” leverage to access resources, accountability, and experienced staff to work on projects that address economic, community, and environmental objectives. Oregon Solutions provided a co-convener to mediate and establish the Columbia River-Umatilla Solutions Task Force to reach solutions on water conflict in Oregon, providing a positive example of collaboration. An organization modeled on Oregon Solutions should be established at the University of Florida, potentially housed in the Public Policy Research Center and should partner with the UF Levin College of Law Conservation Clinic.

### Update Local Comprehensive Plans

The multi-level nested structure undergirding adaptive governance should include significant local government involvement. It is at the local level that the public will become involved to the extent of community engagement and empowerment adequate to effect the changes in Knight’s “recovery recipe.” Most municipal and county comprehensive plans incorporate language related to springs preservation that is copied from the state’s comprehensive plan. The language does not reflect or inspire local needs. Local governments should update their comprehensive plans to reflect local spring and aquifer protection initiatives. Such an effort will require educating and motivating the public to express their concerns and to be heard along with the voices for agricultural and industrial interests.

# CONCLUSION

The problem of declining spring flows in the Florida Springs Region, indicating a water supply issue in the state, is a complex social-ecological problem. As such, efforts to restore and preserve the springs can benefit from an effort to implement all elements of adaptive governance. A successful implementation requires a methodical, coordinated approach. Using a convener to coordinate efforts and conducting a risk assessment to identify the various risks specific to a complete diverse group of stakeholders can evolve the effort to overcome the seemingly irreconcilable differences among the stakeholders in the sustainable management of the Floridan Aquifer System and the region’s springsheds.

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